LIGHTING APPARATUS

Cross-Reference to Related Applications

[0000] This application is a continuation of and incorporates by reference co-pending Application Serial No. 10/070,494, filed March 7, 2002, which claimed priority to Australian Application No. 47417/99, filed September 7, 1999, which are commonly owned with the present invention and which is incorporated herein by reference.

Field of the Invention

[0001] The present invention relates to a lighting apparatus.

Background of the Invention

[0002] Many different types of lights and lighting apparatus are currently available. Largely, these are designed to specifically illuminate an area as distinct from providing some type of visual effect, although illumination is also possible. Embodiments of the present invention are concerned with providing an unusual visual effect. Currently available lights and lighting apparatus that produce unusual effects include LAVA LAMPS and fibre optic lamps. The lava lamp has a clear glass body filled with a carrier liquid and large globules of a second liquid. The second liquid is heated by a light source channelled though the carrier liquid and moves in a random fashion through the carrier liquid. This provides a moving light effect while the lamp itself remains stationary. Common fibre optic lamps comprise in general a light source and a bundle of optical fibre strands emanating from that source. The fibres can be moved by hand or by air currents although the lamp itself again remains stationary.

Summary of the Invention

[0003] It is an object of the present invention to provide an alternate form of lighting apparatus that can produce an erratic or random lighting effect.

[0004] According to the invention there is provided a lighting apparatus comprising:

a light system producing light of remotely controllable variable wavelength;

a controller coupled to said light system which receives signals from a remote device to vary the wavelength of light emitted by said light system;

at least one support member;

a housing containing said light system and to which said at least one support member is rotatably coupled;

a plurality of optical fibre strands supported by respective support members, each strand having a proximal end receiving light from said light system and a length at a distal end extending from its respective support member;

a motor supported by said housing; and,

a transmission system for imparting motion to said support members from said motor to cause said support members to rotate about one or both of respective first axes that extend collinearly with the length of each of said support members and a common second axis, said second axis being non-coincident with at least one of said first axis.

[0005] Preferably said light system further comprises a plurality of multi-coloured light emitting devices which, when in an ON condition emit light having one of a plurality of wavelengths.

[0006] Preferably each light emitting device is a multi-coloured light emitting diode.

[0007] In an alternate embodiment said light system comprises:

a light source;

a multi-coloured filter through which light from said light source must pass prior to entering said optical fibre strands, said multi-coloured filter having a plurality of sections which filter different wavelengths of light; and,

a positioning motor for positioning selected sections of said multi-coloured filter in an optical path between said light source and said optical fibre strands.

[0008] Preferably said sections are arranged so that at any time the filtered wavelength of light entering all of said optical fibre stands is the same.

[0009] In an alternate arrangement, said sections of said multi-coloured filter are arranged so that at any time the filtered wavelength of light entering at least two of said optical fibres is different.

[0010] Preferably said multi-coloured filter comprises a shroud within which said light source is disposed.

[0011] Preferably said multi-coloured filter is mounted to rotate relative to said support members.

[0012] According to the invention there is also provided a lighting apparatus adapted for connection to a source of rotary motion comprising at least:

a housing containing a light source;

a support member rotatably coupled to said housing;

a plurality of optical fibre strands supported by said support member, each strand having a proximal end adapted to receive light from said light source and a length at a distal end extending from said support member; and,

transmission means for imparting motion to said support member from said source of rotary motion to cause said support member to rotate about one or both of a first axis extending collinearly with the length of the support member and a second non-coincident axis;

whereby, in use, when light from a light source enters said proximal ends of said strands and motion is imparted to said support member, said length at the distal end of said strands move in a random manner to produce an erratic lighting effect.

[0013] Preferably said lighting apparatus includes a plurality of support members each rotatably coupled to said housing about respective first axes that extend collinear with the length of said support members.

[0014] Preferably said transmission means for imparting motion includes a first gear mounted in the housing in a manner so that said first gear can rotate relative to the

housing, and a plurality of second gears respective ones of which are coupled to respective proximal ends of each support member and which mesh with said first gear so that rotation of the housing relative to the first gear imparts rotational motion to the support members along said respective first axes.

[0015] Preferably said optical fibre strands are arranged in two or more groups of strands of different length with the length at the distal ends of said different groups of strands extending from the support members at different locations.

[0016] Preferably the lighting apparatus further includes light filter means for filtering light prior to entering said optical fibre strands.

[0017] Preferably the filter means filters the light to produce transmitted light of multiple wavelengths.

[0018] Preferably said filter means is mounted to rotate relative to said support members.

[0019] Preferably said filter means is in the form of a shroud mounted about said light source.

[0020] According to the invention there is also provided a lighting apparatus including at least:

a light source;

at least one support member;

a housing containing said light source and to which said at least one support member is rotatably coupled;

a plurality of optical fibre strands supported by respective support members, each strand having a proximal end adapted to receive light from the light source and a length at a distal end extending from its respective support member;

a motor to provide a source of rotary motion; and

transmission means for imparting motion to said support members from said motor to cause said support members to rotate about one or both of respective first axes that extend collinearly with the length of each support members and a common second axis, said second axis being non-coincident with at least one of the first axes.

[0021] Preferably each support member comprises a plurality of arms joined end to end by coupling sleeves for receiving ends of adjacent arms, said sleeves also provided with a plurality of openings through which the length of the distal ends of selected optical fibre strands can extend.

Brief Description of the Drawings

[0022] Embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a plan view of a lighting apparatus in accordance with one embodiment of the present invention;

Figure 2 is a side elevation view of the lighting apparatus when attached to an electric fan;

Figure 3 is a section view of the lighting apparatus when opened;

Figure 4 is a plan view of the lighting apparatus with its housing open;

Figure 5 is a section view of a support member incorporated in the lighting apparatus;

Figure 6 illustrates a coupling for coupling the lighting apparatus to a fan;

Figure 7 is a representation of a second embodiment of the lighting apparatus;

Figure 8 is a cut-away perspective view of a third embodiment of the lighting apparatus; and,

Figure 9 is a cut-away perspective view of a fourth embodiment of the lighting apparatus.

Detailed Description of the Preferred Embodiments

[0023] Referring to Figures 1-4 of the accompanying drawings, lighting apparatus 10 comprises at least one (in this instance four) support members or arms 12. A plurality of optical fibre strands 14 are supported by each support member/arm 12. Each strand 14 has a proximal end 15 adjacent proximal end 16 of its

corresponding arm 12 that is adapted to receive light from a light source 18. A length 20 at the distal end of each strand 14 extends from its corresponding arm 12. The lighting apparatus 10 also includes a transmission 22 for imparting motion to the arms 12 to cause them to rotate about one or both of a first axis 24 that extends collinearly with the length of the respective arms 12, and a second non-coincident axis 26. In this particular embodiment the second axis 26 extends perpendicular to the first axis 24, however, as explained below, this need not be the case. Thus, in use, when light from the light source 18 enters the proximal ends 15 of the fibre strands 14 and motion is imparted to the arms 12, the arms 12 rotate about their respective axes 24 and simultaneously rotate about the axis 26. This causes the length 20 of the fibres 14 to move in a random and erratic fashion through the air thus providing the erratic lighting effect.

[0024] Looking more closely at the components of the lighting apparatus 10, it can be seen that the fitting 10 includes an outer housing 28. The housing 28 rotatably supports the arms 12 and houses the light source 18 and the transmission 22. Referring to Figures 3 and 4, it can be seen that the proximal end 16 of each arm 12 is held with a bearing bush 30 that in turn is retained within a corresponding radially extending socket 32 formed integrally with the housing 28. An annular circlip 33 is seated in a circumferential groove (not shown) formed about the proximal end 16 of each arm 12 radially inward from bush 30 to prevent the arms 12 from being pulled out of the housing 28.

[0025] The transmission 22 comprises a first gear 34 and a plurality of second gears 36 that mesh with the gear 34. The first gear 34 is fixed to a stationary short hollow shaft 40 that extends along the axis 26 and has an upper portion 40a that is outside the housing 28 and a lower portion 40b that is inside the housing 48. The first gear 34 is fixed to the lower part of the shaft 40b between two bearings 42 and 44, each of which has an inner race that is fixed to the shaft 40. The gear 34 and bearings 42 and 44 are prevented from axial motion along the shaft 40 by being clamped between nuts 46 and 48 each of which engages a thread (not shown) formed on the outer circumferential surface of the shaft 40. The housing 28 is fixed to outer race 50 of the bearing 42. More particularly, the outer race 50 is seated within an inwardly protecting boss 52 formed about axis 26 on the inside of housing 28. By virtue of this coupling it will be appreciated that with the shaft 40 held stationary, the housing 28 can rotate about axis 26 relative to the gear 34 which remains stationary with the shaft 40.

[0026] Each gear 36 is fixed to the distal end 16 of a respective arm 12. The gears 36 are ranged to rotate about axes 24 that are perpendicular the axis 26. Due to the meshing of gears 34 and 36, as the housing 28 rotates relative to the first gear 34, the arms 12 are also caused to rotate about the respective axes 24. When the fitting 10 is attached to a ceiling fan F, the housing 28 is attached to a rotating part of the fan while the shaft 40 would be coupled to a stationary axle of the fan. Electric wires (not shown) are fed through the shaft 40 to provide electrical power to the light source 18.

[0027] Typically the light source 18 is a low voltage (eg 12V) light globe radiating white light. However to increase the visual appeal produced by the fitting 10 a filter 54 is placed between the light 18 and the proximal ends 15 of the fibres 14 so that the distal ends of the fibres 14 can emit light of colour or wavelength other than white. The filter 54 is in the form of a cylindrical shroud 56 that surrounds the light 18 and is supported on a driven holder 58. The holder 58 has an annular flange 60 at an upper end through which the shaft 40 passes. More particularly, outer race 62 of bearing 44 is fixed to a central hole in the flange 60 through which the shaft 40 extends. An outer circumferential surface of the flange 60 is formed with gear teeth 64 that mesh with a gear wheel 66 of a dumbbell shaped gear 68. The dumbbell gear 68 has a shaft 70 extending axially from the gear wheel 66 through the gear 34 and attached at its opposite end to a gear wheel 72. The gear wheel 72 meshes with a gear 74 formed about the outer circumferential surface of the boss 52. Gear wheels 66 and 72 are arranged to have a different diameter and, in this particular embodiment, the gear wheel 66 has a smaller diameter than the gear wheel 72. As the housing 28 rotates about shaft 40, torque is transmitted via the gears 74, 72 and 66 to the holder 58. According the filter 54 also rotates about the axis 26. Because of the difference in the diameter of the gears 72 and 66, the filter 54 rotates more quickly than the housing 28. More particularly, by virtue of this arrangement, there is relative rotation between the filter 54 and the proximal ends 15 of the fibres 14. Thus, by forming the filter 54 as a plurality of panels of different colour the wavelength of the light emitted by the fibres 14 will be seen to change in time.

[0028] The filter 54 is held conveniently by an interference or snap fit into an annular groove 76 formed at a depending end of the holder 58. This allows for convenient and easy interchanging of filters 54 to produce different visual effects.

[0029] The housing 28 is provided with a clip on.- clip off lower cap 78. The clip on – clip off characteristic can be provided by any known technique such as by providing mating annular grooves and protrusions. By making the caps 78 of clear or translucent material, the fitting 10 can also provide "white" downlighting. A standard diffuser screen or disc 80 is mounted on the inside of the cap 78 below the light 18 to further assist in dispersing white light in a downward direction.

[0030] As shown in Figures 1 and 2, the optical fibres 14 are arranged in groups of different lengths. In this way, the length 20 at the distal end of each group of strands is able to exit the arms 12 at different locations. In this embodiment, the fibres are arranged in two different groups so that they emanate from the arms 12 at different locations 82 and 84. This can be achieved by providing openings in the arms 12 through which the lengths 20 are passed. However to simplify the manufacture, as shown in Figure 5, each arm 12 can be made from a plurality of short lengths 12A and 12B coupled together by a sleeve 86 that is provided with a plurality of openings or slits 88 through which the lengths 20 can pass. The positioning of the lengths 20 can also be effected by forming the slits 88 at an acute angle or having some of the slits 88 arranged at different acute angles.

[0031] An end sleeve 90 is provided at the distal end of arm 12 and is similarly provided with slits 88 through which the lengths 20 of the second group of strands can pass.

[0032] It is envisaged that the arms 12, (including lengths 12A, 12B) as well as the sleeves 86 and 90 will be made from an opaque material. A particularly well suited material would be aluminum tubing. In this manner, the light would emanate only from the distal ends of the lengths 20 of the strands 14.

[0033] Figure 6 illustrates how a fitting 10 is attached to a rotating motor of a fan F. The motor of the fan F generally has a fixed axle or another stationary fixing point to which the shaft 40 can be attached by way of a threaded sleeve 92. By this coupling, the shaft 40 is held stationary. In order to impart rotational motion to the housing 28, the coupling between the fitting 10 and the fan F also includes a resilient coupling 94. In this embodiment the resilient coupling 94 includes a pair of stick-on plates 96 of each being stuck to the outside of the housing 28 and the fan F in a mutually opposing juxtaposition, and a spring 98 which is coupled at its opposite ends the respective ones of the plates 96. This can be achieved by providing a small hole 100 in each plate 96 into which opposite ends of the spring 98 can be inserted with an interference fit.

[0034] When the fan F is operated so that its outer housing rotates, the rotational motion is transferred via the coupling 94 to the housing 28. Not only is the coupling 94 resilient but it is also frangible so that if the arms 12 is an obstacle (such as a child's

arm) the coupling 94 can be broken by the spring 98 pulling out of one or both of the plates 96 thus decoupling torque from the fan F to the housing 28. The coupling 94 can be easily reinstated by simply inserting opposite ends of the spring 98 back into the holes 100 of the plates 96.

[0035] Figure 7 illustrates a further embodiment of the lighting apparatus 10' having a plurality (three) tiers or layers of arms 121, 122 and 123. To accommodate the three tiers of arms 121-123 the housing 28 is extended in its axial length. The first tier of arms 121 are arranged in an identical manner to the arms 12 depicted in Figures 1-5. The second tier of arms 122 are arranged in a like fashion to the first tier 121 but are off set about axis 26 by 30° relative to arms 121. The arms 122 are provided at their proximal ends with gears (not shown) that mesh with gears 36 of arms 12, to provide rotational motion to arms 122. However, the gearing of arms 122 can be arranged so that they rotate in the opposite direction to arms 121.

[0036] The third layer or tier of arms 123 extend at an acute angle to both the axis 26 and the axes 24 of the arms 121, 122. Arms 123 also rotate about selective axes coincident with their length by way of similar gearing arrangement to arms 121 and 122. The arms 123 are offset by a further 30° about axis 26 so that angularly there is one arm 122 and one arm 123 between adjacent arms 121.

[0037] Further, in the lighting apparatus 10' the fibres 14 held in any one of the arms 121-123 are arranged into three groups so as to emanate from the arms at three

different locations, 82, 84 and 85. Additionally the end caps 78 is provided with a plurality of downwardly depending fibres 14'.

[0038] Figure 8 illustrates a further embodiment of the lighting apparatus 10" in which similar features are denoted by the same reference numbers.

[0039] The main differences between the lighting apparatus 10" and the apparatus 10 and 10' are: the forming of the housing 28 as two separate housing parts 28a and 28b; the inclusion of a motor 110 within the housing 28 to impart rotary motion to the support members 12; the provision of the lighting system 112 which produces light of remotely controllable variable wavelength; and, an associated controller 114 for receiving signals from a remote device to vary the wavelength of light transmitted by the lighting system 112.

[0040] Looking at the lighting apparatus 10" in more detail, the housing 28 comprises an upper cylindrical portion 28a and a lower cylindrical portion 28b. The portions are arranged coaxially and rotatable relative to each other. A peripheral skirt 116 is formed on an upper wall 118 of the cylindrical portion 28b and extends axially and inside of a lower end of the cylindrical portion 28a. The skirt 116 covers a gap between the cylindrical portions 28a and the upper wall 118 of the cylindrical portion 28b. An annular wall 120 is also formed coaxially with the cylindrical portion 28b on the upper wall 118 and inside of the skirt 116. This wall is used to impart drive from the motor 110 to the cylindrical portion 28b and, the arms 12 via the transmission system 22. More particularly, the motor 110 rotates a shaft 122 to which is attached a wheel

124 that contacts an outer surface of the wall 120. Thus as the motor turns the shaft 122, the wheel 124 rotates and due to contact with the annular wall 120 turns the cylindrical section 28b relative to the cylindrical portion 28a. The transfer of drive between the wheel 124 and the annular wall 120 may be by way of friction only, for example by forming the wheel 124 as a rubber wheel which is biased into contact with the wall 120; or alternately by a gear system where the wheel 124 is formed as a gear wheel and the annular wall 120 is provided with gear teeth on its outer surface which mesh with the teeth on the wheel 124.

[0041] The transmission system 22 in the apparatus 10" is in substance the same as that described in relation to the earlier embodiments. In particular, the transmission system 22 includes a first gear 34 which is fixed to one end of a stationary shaft 40. An opposite end of the shaft 40 is attached to a bracket 126 enabling attachment of the apparatus 10" to a wall. Wires 128 carrying electricity for powering the apparatus 10" enter the housing 28 through the shaft 40. The cylindrical portion 28b of the housing 28 is supported by bearings 42 and 44 mounted on the shaft 40 to enable the portion 28b to rotate relative to the stationary shaft 40 and portion 28a.

[0042] Each of the gears 36 of the transmission 22 is fixed to a distal end 16 of a respective arm 12. Due to the meshing of the gears 34 and 36, as the portion 28b rotates relative to the portion 28a as a result of drive imparted by the motor 110, the arms 12 are caused to rotate about their respective axis 24. In addition, the portion 28b rotates about longitudinal axis 26 of the housing 28. The light source 18 of the apparatus 10 and 10' is replaced in the present embodiment by the lighting system 112

which is able to provide remotely controllable light of different wavelengths. The lighting system 112 in this embodiment comprises a plurality of multi-coloured light emitting devices in the form of multi-coloured LEDs 130. Each LED 130 is able to emit one of four different wavelengths. A separate LED 130 is provided for each arm 12. The LEDs 130 are mounted on a mounting box 132 which also contains the controller 114 which operates on signals received from a remote device to determine which wavelength of light is emitted by each of the LEDs 130. The controller 114 can be arranged to drive the lighting system 112 so that at any time each LED 130 emits the same wavelength. However the controller 114 may also be arranged to control the lighting system 112 so that at any time at least two of the LEDs 130 are emitting light of different wavelengths. The controller 114 may also be receptive to a signal from the remote device to provide random rhythm control over the LEDs 130 so that they change colour in accordance with the beat of music.

[0043] In a further variation from the apparatus 10 and 10', a separate LED 136 is provided which emits down light from the housing 28. The LED 136 can be controlled by the controller 134 or separately any can provide for example white light when the LEDs 130 are in an OFF condition. Alternately the LED 136 may be a multi-coloured LED in which one of the wavelengths of light transmitted corresponds to white light with the LED 136 being controlled so that white light can be emitted when the LEDs 130 are in either an ON or an OFF condition.

[0044] Electrical power for the LEDs 130, 136 and the controller 114 is provided by wire 128 via an electrical contact disc 138 which is fixed to the cylindrical portion

28a. A contact bush 140 provides electrical coupling between an end of some of the wires 128 which extend through the shaft 40 and the contact disc 138. A sliding contact 142 makes contact with an under side of the contact disc 138 and is coupled to a connector 144 for providing power to the LEDs 130, 136 and controller 114.

[0045] A fan 146 is mounted within the cylindrical portion 28a of the housing 28 for cooling the motor 110. Optical fibres (not shown) are held within the arms 12 in the same manner as described in relation to the apparatus 10 and 10'.

[0046] In use, the apparatus 10" is typically fitted to a ceiling (not shown) as a stand-alone item rather than being connected to a fan. The arms 12 and thus the optical fibres carried thereby, are able to rotate about both their respective longitudinal axis 24, and the axis 26 of the housing 28. The colour of light emitted by the optical fibres is dependent upon the colour of light emitted by each of the LEDs 130. The colour of light transmitted by the LEDs 130 is controlled by the controller 114 which receives signals from a remote device. The controller 114 can take the form of a microprocessor which is programmed to drive the lighting system 112 in any one of a variety of ways dependent on the signal emitted by the remote device. The remote device can take the form of a wireless hand-held transmitter emitting radio or infrared frequency signals of a type similar to those used for controlling televisions, VCRs, roller doors, etc.

In this instance the controller 114 includes a receiver 133 (shown in Figure 9) for receiving the radio or infrared signals. Alternately the remote device may be a lighting

console connected to the controller 114 by a cable. In this instance the apparatus 10" may include a lug or connector (shown in phantom as item 133' in Figure 9) for coupling to a network lighting console operating under the DMX standard.

[0047] Figure 9 depicts the fourth embodiment of the lighting apparatus 10"' which, like the apparatus 10", has a lighting system 112 producing light of remotely controllable variable wavelength although of different construction. In the lighting apparatus 10"' the housing 28 is composed of coaxially arranged cylindrical portions 28a and 28b which are rotatable relative to each other, and motor 110 for rotating the cylindrical portion 26b relative to the portions 28a, and imparting drive to the transmission system 22. The housing 28a also contains a fan 146 for cooling the motor 110.

[0048] The substantive difference between the apparatus 10"' and the apparatus 10" is in the form of the lighting system 112. In the apparatus 10"', the lighting system 112 comprises a light source 18 of white light, and a multi-coloured filter 148 in which the light source 18 is disposed. Moreover, the multi-coloured filter 148 is arranged so that light emitted from the light source 18 must pass through the filter 148 prior to entering the optical fibres (not shown) held within the arms 12. The lighting system 112 includes a stepper motor 150 for axially moving a sleeve 152 which in turn carries the filter 148 and light source 18. The sleeve 152 is attached by a bracket 154 to a shaft 156 of the motor 150. The sleeve 152 is also slidably mounted on a post 158 which is coaxial with the shaft 40. The controller 114 receives signals from a remote device to control the stepper motor 150 to cause the shaft 156 and thus the sleeve 152 and

multi-coloured filter 148 to move axially up or down. The multi-coloured filter 148 is formed from a plurality of sections A-E which filter different wavelengths of light. Thus the wavelength (i.e. colour) of light transmitted by the optical fibres (not shown) supported by the arms 12 is controlled by moving the multi-coloured filter 148 axially up or down to vary the section A-E of the filter 148 lying in an optical path between the light source 18 and a proximal end of the optical fibres.

[0049] The stepper motor 150, sleeve 152, bracket 154 and post 158 are disposed within a canister 160 located inside the cylindrical portion 28b but fixed to the shaft 40. The gear 34 is formed integrally with the canister 160.

[0050] In use, the motor 110 causing the cylindrical portion 28b to rotate about axis 28 relative to the cylindrical portion 28a, and via the transmission system 22, causes the arms 12 to rotate about their respective longitudinal axis 24. The motor 150 under the control of the controller 114 is able to vary the colour of light emitted by the optical fibres by placing different sections A-E of the multi-coloured filter 148 in the optical path between the light source 112 and the optical fibres.

[0051] In one embodiment, the multi-coloured filter can be formed with sections A, B, C and D each of one a different colour, for example section A all green, section B all blue, section C all red, and section D all yellow, with section E being multi-coloured so that it has sides E1, E2, E3, and E4 of different colour, e.g. side E1 being green, side E2 being blue, side E3 being red and side E4 being yellow.

[0052] If desired, the controller 114 may have a random rhythm control to cause the stepper motor 150 to move axially with the beat of music.

[0053] Now that an embodiment of the invention has been described in detail it will be apparent to those skilled in the relevant arts that numerous modifications and variations may be made without departing from the basic inventive concepts. For example, any number of arms 12 can be used in the lighting apparatus 10. Additionally, while the strands 14 are illustrated as emanating from the arms 12 at two (Figures 1 & 2) or three (Figure 7) different locations, further groups of strands can be provided so as to emanate from more locations along the arms 12. If desired, the arms 12 can be made from a transparent or translucent material so that light passing along the optical fibre strands can be visualised along the arms 12. Additionally, any type of gearing arrangement or other drive arrangement can be provided for imparting motion to the arms 12.

[0054] Further possible modifications and variations include making different arms 12 of different length and/or different strands 14 of different length. In addition, a heat sensor/power shut off circuit can be provided within the housing 28 to shut off power to the light 18 or lighting system 112 if the temperature within the housing 28 exceeds a nominal value. Ventilation holes (not shown) can be provided within the housing 28 to assist in dissipation of heat from within the housing 28.

[0055] The filter 54 can be configured in many different ways. For example, the filter can be split up into four quadrants each of which filters a different wavelength of

light, for example red, blue, green, yellow. Alternately, the filter can be segmented into a large number (for example, sixteen) axial bands which alternate in two or more colours.

[0056] Also, an adjustable gearbox or other gear train can be provided coupling the holder 58 to the gear 74 to allow adjustment of the rate of rotation of the filter 54 relative to the arms 12.

[0057] All such modifications and variations together with others that would be obvious to a person of ordinary skill in the art are deemed to be within the scope of the present invention the nature of which is to be determined from the above description and the appended claims.